



Field Report
Kidepo Valley National Park
Uganda

**Understanding the Status and Ecology of Nubian
Giraffe**
March 2019



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The vast savannahs and striking mountainous terrain of Kidepo Valley National Park (NP) provides a stunning backdrop for a historically significant population of Nubian giraffe (*Giraffa camelopardalis camelopardalis*). This rugged landscape is home to one of only two remaining naturally occurring populations of giraffe in Uganda. The current Kidepo Valley NP population, however, is only a small remnant of its prior size. What was once the historical stronghold of giraffe in Uganda, numbers in Kidepo significantly reduce over a period of civil unrest and intense poaching, bringing this important population to the brink of local extinction. Despite stabilisation in the region and positive conservation efforts of the Ugandan Wildlife Authority (UWA), giraffe in Kidepo Valley NP have not returned to their previous population size. Recognising the need for reliable ecological data to inform the draft National Giraffe Conservation Strategy and Action Plan, the Giraffe Conservation Foundation (GCF) and partners developed an annual conservation monitoring programme in 2015. This programme has grown from its early foundations in establishing baseline data on population size, structure and distribution to including a comprehensive population genetics study and a cutting-edge GPS satellite tracking effort to better understand the movement ecology of these giraffe. Additionally, in August 2018 UWA with the support of GCF and partners undertook the successful translocation of an additional 14 Nubian giraffe from Murchison Falls NP to Kidepo Valley NP as a key component to augmenting the small but slowly growing population.

In March 2019, the GCF team and partners again travelled to Uganda's north eastern frontier region to continue this study to deepen insights into the ecology of giraffe in Kidepo Valley NP and identify threats to this critical population of Nubian giraffe.

Brief History of Giraffe in Kidepo Valley National Park

Study Area

Located in north-eastern Uganda, and bordering South Sudan and Kenya, Kidepo Valley NP is comprised of the Narus River Valley in the south and west, and the Kidepo River Valley in the north and east (Harrington & Ross 1974) (Fig 1). The Park's rivers are seasonal, with the Narus River Valley being the only water source during the dry season (Aleper & Moe 2006). Ranging in altitude from approximately 1,000-2,750 m above sea level (Aleper & Moe 2006) an array of habitat is found within the Park, from arid plains and open savannas, to hills, rocky outcroppings, and mountain ranges. The Park itself is an especially biodiverse region, with over 80 species of mammals found within its borders (Aleper & Moe 2006).



Figure 1: A map of current distribution of giraffe in Uganda.

In 1962, the year of Uganda's Independence, 1,259 km² were initially gazetted as Kidepo Valley NP and an additional 181 km² were added in 1967. During the time leading up to the Park's official designation, poaching was relatively small scale and localised with traditional weapons. From the late 1970s, however, the severity of these threats changed as Idi Amin's army was overthrown by the Tanzanian army and Obote forces, resulting in a proliferation of firearms among the local Karamajong people. This development led to increased violence in the region, including poaching and cattle raiding. In 1986, Museveni became President of Uganda, but this change in leadership had limited impact on the region. Since travel to the Park was limited to air, few people ventured there, and tourism remained largely underdeveloped. Interestingly, even the Lord's Resistance Army (LRA) avoided the region. Under-resourced park staff could do little throughout this period to mitigate the threats which included grazing in the Park and transhumance activities between Kenya, Uganda and South Sudan. Unfortunately, several wildlife species became locally extinct, including rhino, roan antelope and African wild dog, while giraffe numbers were reduced to an estimated three individuals.



In 2001 various voluntary and forced disarmament programmes were instituted to reduce the estimated 40,000 guns in the Karamajong Region. However, this policy led to a virtual state of war between the local people and the Ugandan army. By 2006 the last remnants of the LRA were forced out of northern Uganda which opened the route into the region and for the first time in twenty years the Park was safely accessible by vehicle (Uganda Wildlife Foundation 2014).

Population Trends of Nubian Giraffe Populations in Kidepo Valley NP

The historic distribution of Uganda's Nubian giraffe ranged from the Rift Valley of central-west Kenya across Uganda to the Nile River and northwards into (South) Sudan (Dagg & Foster 1976). In the early 1960s, Dagg (1962) estimated Rothschild's giraffe in Uganda at 1,130 individuals. In contrast, Rwetsiba (2005) reported that Rothschild's giraffe in Uganda numbered approximately 2,500 in the 1960s. By the early 1980s, the population had decreased to ~350 giraffe (Rwetsiba 2005).

It is important to note, although Dagg (1962) referred to *G. c. cottoni* and *G. c. rothschildi*, *G. c. cottoni* was previously subsumed into *G. c. rothschildi* (Dagg 1971), and more recently *G. c. rothschildi* subsumed into *G. c. camelopardalis* (Fennessy et al. 2016; Winter et al. 2018). By the mid to late 1990s, East (1999), who combined Nubian and Rothschild's giraffe, estimated the total number of Nubian giraffe in Uganda at 145 individuals, most of which occurred in Murchison Falls NP. In contrast to this figure, Rwetsiba (2005) estimated Uganda's giraffe population to number 250 individuals during the same timeframe. Currently, giraffe are only found in three national parks: Murchison Falls NP contains the largest population – 1,450 in the north and 37 introduced into the south in 2016-17, which has now grown to an estimated 45 individuals; Lake Mburo NP introduced 15 giraffe in a re-introduction translocation effort from Murchison Falls NP in 2015 and the population has grown to approximately 24 individuals in March 2019, and in August 2018 Kidepo Valley NP hosted to an imperilled but newly augmented population of 49 individuals (Brown et al. 2018).

Kidepo Valley NP formerly supported one of the country's largest protected Nubian/Rothschild's giraffe populations (East 1999), with an estimated 400 giraffe in the late 1960s/early 1970s (NEMA 2009; Rwetsiba 2005; Nampindo et al. 2005). The population decreased to an estimated 160 giraffe in 1982 (NEMA 2009; Rwetsiba & Wanyama 2005) and by 1993, a mere three individuals were thought to remain (Reynolds 1993). Three Rothschild's giraffe (one male and two females) were successfully translocated from Kenya's Lake Nakuru NP to Kidepo Valley NP in 1997 to promote the recovery of the Park's giraffe population (Uganda Wildlife Foundation 2014; Rwetsiba & Wanyama 2005; East 1999; Lamprey & Michelmore 1996).

In 2002, nine giraffe were estimated to remain in the Kidepo Valley Conservation Area (KVCA) (Rwetsiba & Wanyama 2005). In 2005, the first aerial total count of wildlife in the KVCA counted 14 giraffe, all of which occurred in the southern parts of Kidepo Valley NP (Rwetsiba & Wanyama 2005). Muller (2011) estimated Kidepo Valley NP's giraffe population at <20 individuals. An aerial survey of Kidepo Valley National Park in 2014 identified 20 giraffe within the Park (Wanyama et al., 2014). In 2015 and 2016, GCF vehicle based photographic surveys documented 28 unique individuals and estimated 30 giraffe in the population, respectively. In 2017, 34 Nubian giraffe individuals were estimated by GCF from individual IDs. In April 2018, the population was estimated at 35 unique individuals during the annual survey. This



population then received a boost of 14 giraffe (1 male and 13 females) from Murchison Falls NP during the *Operation Twiga III* translocation held in August 2018, bringing the total population up to 49 individuals.

Current Research Efforts in Kidepo Valley NP

Nubian giraffe in Uganda are currently estimated to number >1,575 individuals remaining in the wild across Murchison Falls NP, Kidepo Valley NP and Lake Mburo NP. Conservation research on the Nubian giraffe has been identified as a conservation priority by GCF and the IUCN SSC Giraffe & Okapi Specialist Group, and GCF in partnership with UWA, Uganda Wildlife Education Centre (UWEC) and Dartmouth College have worked together in Uganda since 2013.

This conservation programme seeks to build on the first four annual comprehensive assessments of Nubian giraffe numbers in Kidepo Valley NP undertaken by GCF, UWA and partners since 2015. The Kidepo Valley NP giraffe population likely faces the hallmark threats of a small, recovering population potentially including inbreeding depression from a genetic bottleneck and top down population regulation. Given the estimated small population size, it is susceptible to demographic and environmental stochasticity, requiring a close monitoring of population dynamics to quickly identify and mitigate potential and emerging threats. This survey provides an invaluable update on the initial baseline collected to address gaps in knowledge for the IUCN Red List Assessment of the Nubian giraffe, as well as for the implementation of the first-ever draft National Giraffe Conservation Strategy and Action Plan in Uganda 2017-2027.

Project Objectives – March 2019

1. To re-survey the Nubian giraffe population size, distribution and threats in Kidepo Valley NP.
2. To collect additional DNA tissue samples from Nubian giraffe in Kidepo Valley NP to better understand social relationships.
3. To (re)tag five GPS satellite units to Nubian giraffe in Kidepo Valley NP.
4. To provide ongoing capacity building and support to UWA monitoring staff in Kidepo Valley NP.
5. To provide valuable data for the 'living' Uganda country-wide status report and Uganda's draft National Giraffe Conservation Strategy and Action Plan 2017-2027.

Population Monitoring

Methods

The primary data collection method for population monitoring was a vehicle-based fixed route photographic survey to obtain a total count of giraffe over the survey period. Since each individual giraffe has a unique pelage pattern, photographs of observed giraffe were compared with previously photographed giraffe to ensure that repeated sightings of an animal did not result in increased population estimates.

We conducted surveys daily between 7-9 March 2019, from approximately 8:00am to 4:00pm during each day. Using survey routes and protocols established in 2015, combined with data from GPS satellite



units fitted to giraffe in the park, the southern section of the Park has been identified in the Kidepo Valley NP as the preferred habitat for giraffe. We used two survey teams to drive each route during every survey day, ensuring complete coverage of the Park’s road network over all survey events; two vehicles during each survey period: (1) North and West of Apoka, and (2) South and East Apoka. Each survey vehicle had a driver, a research team with survey equipment, and an UWA ranger. The UWA rangers proved invaluable in guiding the survey teams to vantage points within the Park along the various routes. Their knowledge of the Park allowed us to track the giraffe so to get close enough to photograph and/or identify them.

When giraffe were encountered, photographs were taken of all individuals and the location, age class (Calf: 0-1 year; Subadult: 1-5 years; Adult: 5+ years), sex, group composition, injuries and any visible signs of disease were also noted. Using pattern recognition software, the database of unique individual giraffe in the Park was updated to include observations from 2015-18 surveys and was subsequently added online to GiraffeSpotter (giraffespotter.org). As part of long-term monitoring, the capture history records of individual giraffe were generated from repeated photographic surveys which enable the monitoring of both individual space-use and population distribution over time. All individual giraffe encounters and matches were visually confirmed by researchers to ensure positive identifications.

Results

During the survey period, we documented 130 giraffe observations and 12 group observations. From these encounters, we identified **57 unique individual giraffe** in the Park, including 12 newly identified calves/subadults. Since the previous study, one adult male was found deceased in November 2018 by the UWA monitoring team and its ID was confirmed during the survey. Four adult/subadult males were not re-sighted during the 2019 surveys, but based on information from UWA rangers were presumed to be in a small bachelor herd not in the area during the survey period. Additionally, one calf encountered in 2017 was not re-sighted during the 2018 or 2019 surveys and can be assumed deceased. In total, we estimate **61 individual giraffe** in the Park, which includes the four unobserved during the survey. The current population structure is skewed towards adult, which is consistent with other healthy ungulate populations and the sex ratio is 0.6 males/female, suggesting no significant sex bias in survival parameters (Table 1). None of the observed giraffe showed any sign of snare wounds. The only giraffe to show evidence of giraffe skin disease (GSD) were individuals translocated from Murchison Falls NP that had previously been documented with GSD.

Table 1: Giraffe population structure in Kidepo Valley National Park

	Calf	Subadult	Adult	Total
Male	6	5	11	22
Female	4	4	25	33
Unknown	2	-	-	2
Not Sighted		2 (Male)	2 (Male)	4
Total	12	11	38	61



All giraffe encounters were in the southern part of the Park, along the Narus Valley. This spatial distribution of encounters is consistent with all prior GCF surveys with no giraffe encounters ever documented outside of the Narus Valley.

All the data collected during these surveys will be added to the GCF Uganda Country Profile to help inform future conservation measures and the draft National Giraffe Conservation Strategy and Action Plan. In time, the information will also be incorporated into future IUCN Red List assessments of the Nubian giraffe.

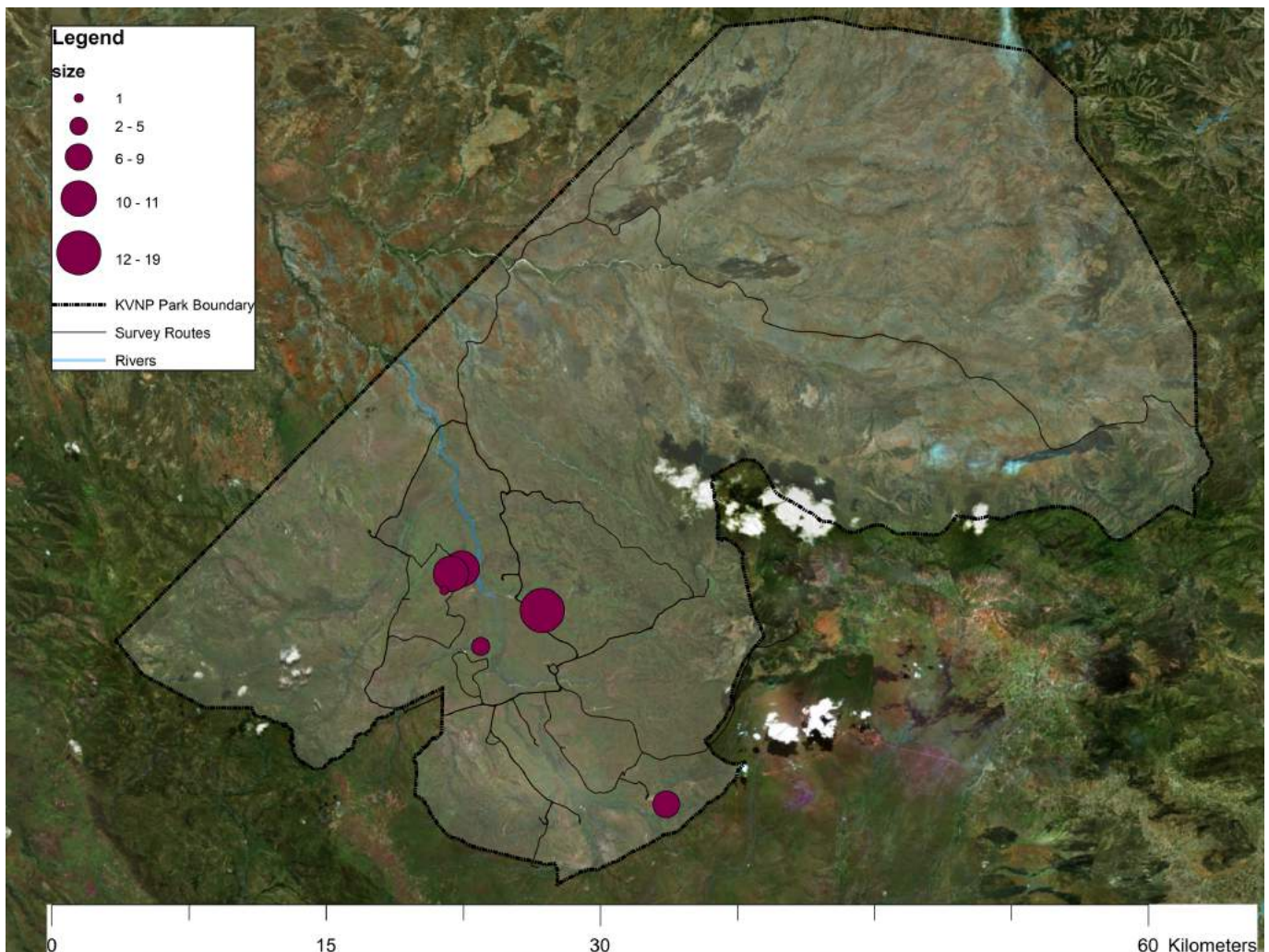


Figure 2: A map of Kidepo Valley NP showing the locations and sizes of all observed groups of giraffe during the 2019 survey.

Spatial Ecology

Methods

To better understand the spatial ecology of giraffe in Kidepo Valley NP and to inform park-specific management, future giraffe reinforcement translocations, and other strategies for the conservation of this flagship species, we deployed five newly developed solar-charged GPS satellite tracking units on giraffe in April 2018. This GPS tracking programme is part of an Africa-wide effort, *Twiga Tracker*, an initiative spearheaded by GCF working in collaboration with the Smithsonian Conservation Biology Institute, San Diego Zoo Global and Wildlife Conservation Alliance to better understanding spatial



ecology of all giraffe species throughout the continent.

GCF and partners undertook the first preliminary study of giraffe movements in Kidepo Valley NP during 2016-17, testing the newly developed GPS satellite units. To build a baseline of understanding giraffe spatial ecology in the Park, we fitted five additional giraffe with ossicone mounted GPS satellite tracking units (Fig 3) in April 2019. Three of these units ceased reporting (two males knocked off their units), one additional unit fitted to one of the translocated giraffe also failed and thus all were replaced with new GPS satellite units in March 2019. One new female also had a GPS satellite unit fitted in March 2019, bringing the total number of GPS tagged giraffe in Kidepo Valley NP up to eight individuals.



Figure 3: A solar charged GPS tracking unit attached to the ossicone of an adult female Nubian giraffe.

These solar charged tracking units were designed by the Kenyan based company Savannah Tracking and programmed to record coordinate fixes at one-hour intervals. Spatial data are uploaded to a server via Iridium satellite uplink twice daily to allow for real-time monitoring of tracked individuals.

Collaring operations took place on 9-10 March 2019. The immobilisation and collaring team consisted of one UWA veterinarian, one technician, UWA wardens, UWA rangers and UWA drivers, supported by individuals from GCF, San Diego Zoo Global, Chester Zoo, Naples Zoo and Rolling Hills Zoo.

All giraffe were immobilised using a combination of etorphine (M99) and azaperone, with dosages commensurate with the estimated weight. Once the giraffe was safely secured on the ground, the reversal naltrexone was immediately administered intravenously. Each giraffe was restrained for approximately 15-20 minutes while the GPS satellite units were fixed. Each unit was attached to the ossicone using two surgical steel bolts and nylon webbing. While the giraffe was restrained, we also collected morphometric data as well as tissue and blood samples. Each giraffe also received antibiotic and anti-inflammatory injections.



All giraffe were monitored following fitting the units to ensure they were behaving normally and did not exhibit any signs of injury or distress. All giraffe safely returned to their respective herds after they were released. The UWA monitoring team in Kidepo Valley NP continue monitoring of the giraffe as part of their field programme.

Results

Preliminary data from the GPS satellite units has been mapped and presented below (Fig 4.) The exhibited movement behaviours from tracked giraffe are consistent with the spatial distribution of giraffe herds exhibited during surveys in that movement appears to be restricted to within the Narus Valley of the southern half of the Park. Most giraffe have exhibited different movement patterns in the densely vegetated areas along the eastern and western edges of the Park versus when moving in the river valley. Further analyses is need to understand these differences, but potentially due to foraging activity. Additionally, movement behaviours have begun to reveal insights into fission/fusion dynamics of giraffe social behaviour. Although the collared giraffe were in four distinct herds during the collaring operations, tracked individuals regularly converged and separated over the duration of the tracking period.

DNA Data Sampling

During the immobilisation and collaring of the giraffe, we collected tissue samples from all new giraffe for future DNA analysis. Throughout all survey, translocations and sampling efforts we have collectively sampled tissue from 51 individuals – 83% of the current total population. The identity of all individuals from which DNA biopsy tissue samples were collected was noted and we plan to continue genetic sampling for all individuals in the population to have a full record of their population dynamics for ongoing analysis with GCF's partner genetics laboratory in Germany, the Senckenberg Biodiversity and Climate Research Centre BiK-F.

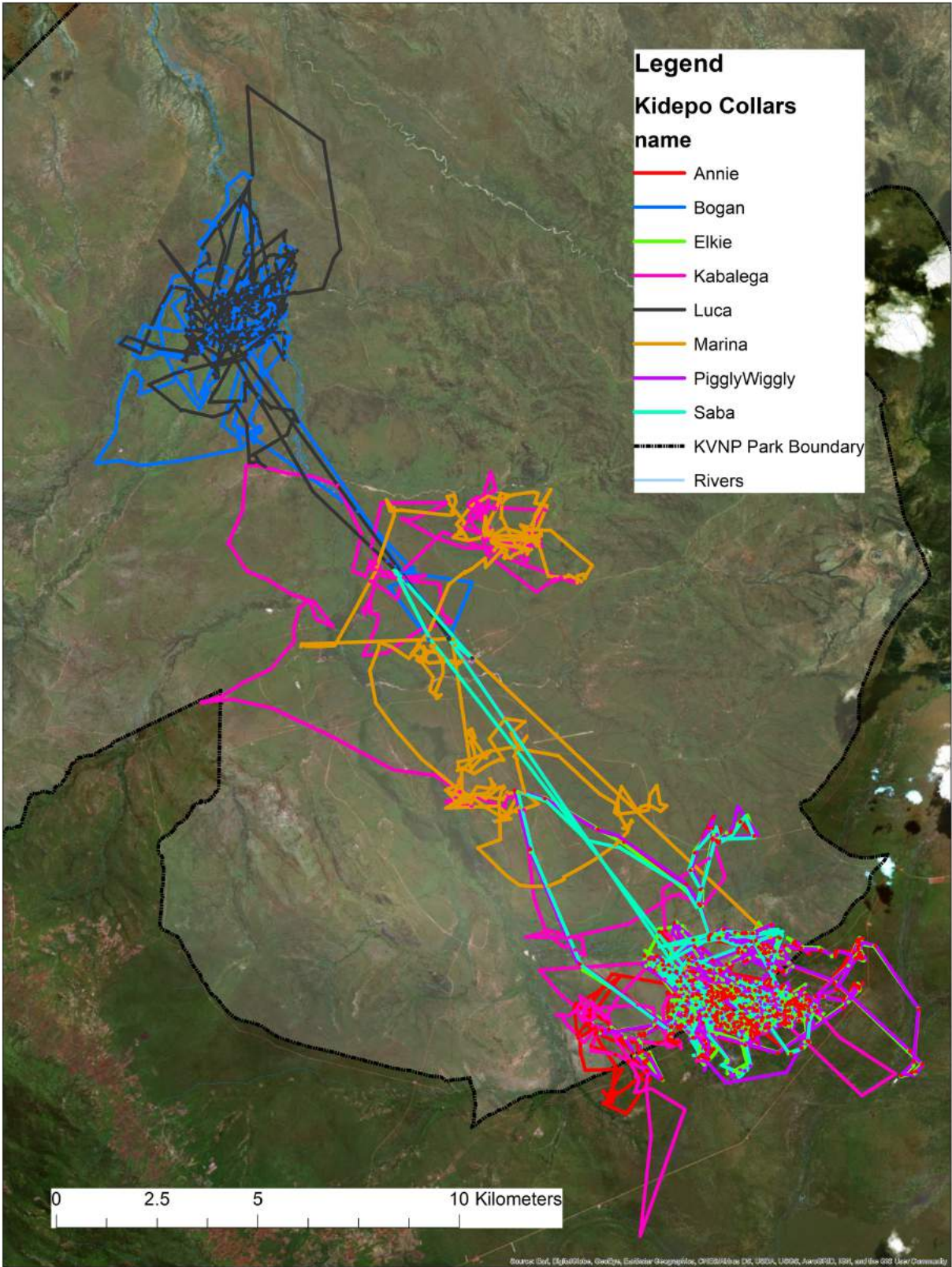


Figure 4: A map of preliminary telemetry data from the five (two males and three females) recently deployed ossicone-mounted GPS satellite units as well as the three (all females) which still work.



Goals	Specific	Measurable	Assignable	Relevant	Time-bound	Outputs
<i>Uganda</i>						
1. To collect and analyse DNA tissue samples from Nubian giraffe in Kidepo Valley NP to assess social relationships. 2. To re-survey the Nubian giraffe population size, distribution and threats in Kidepo Valley NP 3. To fit five GPS satellite units to Nubian giraffe in Kidepo Valley NP 4. To provide capacity support to UWA team in Kidepo Valley NP 5. To provide valuable data for the 'living' Uganda country-wide status report and draft Uganda's National Giraffe Conservation Strategy and Action Plan	Develop key giraffe conservation outputs to support Nubian giraffe long-term conservation and management	New DNA tissue samples collected from giraffe in Kidepo Valley NP Updated report submitted highlighting current population numbers, distribution and threats of giraffe in Kidepo Valley NP Five GPS satellite units fitted to giraffe in Kidepo Valley NP and provide regular reports on their movements. UWA staff capacity built for capture and ongoing monitoring of the Kidepo Valley NP giraffe population New data added to the Uganda Country Profile and National Strategy and Action Plan	GCF with partners including UWA, Chester Zoo, Dartmouth College	Ongoing DNA tissue sampling of giraffe in Kidepo Valley NP to assess social relationships Ongoing survey of population numbers, distribution and threats of giraffe in Kidepo Valley NP GPS satellite tagging of five Nubian giraffe in Kidepo Valley NP Training of UWA rangers in giraffe capture and monitoring	Project preparation – January 2019 Field work – March 2019 Initial reporting – June 2019 Ongoing reporting thereafter	Additional DNA tissue samples collected (cumulatively 83% of the population) Survey report completed Four giraffe re-tagged; One new giraffe tagged Training of UWA staff undertaken on giraffe capture and monitoring. Giraffe translocation success documented – two calves born from new giraffe New data to be added to Uganda Country Profile and conservation status report.



Conservation Outcomes

Kidepo Valley NP is home to the second largest Nubian giraffe population in Uganda, and as such, conservation strategies for this unique northern subspecies hinge on a detailed understanding of their population dynamics, spatial requirements and ecology. Our broader and ongoing evaluation of their numbers and current threats to the population in Uganda in collaboration with UWA and UWEC, and technically supported by Dartmouth College has to date provided valuable outputs, including the translocation of 15 giraffe to Lake Mburo NP (new calves have been born), 37 giraffe to the south side of Murchison Falls NP (new calves have been born), 14 giraffe to Kidepo Valley NP, population surveys and monitoring in all Parks, and the development of a draft National Giraffe Conservation Strategy and Action Plan. The findings from this project have already provided a critical baseline to help with future conservation efforts for Nubian giraffe in the Park, as well as the country at large.

Importantly, conservation translocation has been identified as a key tool to further secure Nubian giraffe numbers and range in Uganda. As an example, a detailed understanding of the population structure in Murchison Falls NP as a potential source population is an essential component of safely removing individuals and using them to propagate viable populations in other areas of Uganda. GCF drafted a translocation viability assessment using the IUCN guidelines to help better inform UWA about this potential activity. In August 2018 UWA in collaboration with GCF and their partners successfully translocated 14 giraffe from Murchison Falls NP to Kidepo Valley NP. All 14 individuals were observed during the March 2019 survey period and were fully integrated with the residential population and doing well in their new environment. As a further litmus test of their successful introduction, two of the females have new calves. Additionally, our current conservation research efforts in Murchison Falls NP and knowledge of group structure, preferred associations and social dynamics, coupled with detailed understanding of giraffe skin disease issues, should provide for a social consideration when selecting individuals for translocations in the future. All this work has been initiated through this project and in future findings will help us to make informed recommendations and decisions.

With the ongoing monitoring of the Kidepo Valley NP giraffe population, a better understanding of giraffe by all stakeholders can help to further develop their long-term conservation and management. Our work will continue to inform the implementation of the current draft National Giraffe Conservation Strategy and Action Plan for Uganda.

Next Steps: 2019-20

A series of recommendations for future giraffe conservation and management in Kidepo Valley NP are outlined below and relate directly to the draft National Giraffe Conservation Strategy and Action Plan for Uganda. As a priority, the following has been highlighted to follow up by UWA, GCF and partners:

- Finalise biopsy tissue sampling of remaining individuals for creating pedigree of entire Kidepo Valley NP giraffe population.
- Monitoring of giraffe with GPS satellite units to assess movements in and around Kidepo Valley NP for ongoing conservation monitoring and management.
- Regular annual survey (2020) and further training and capacity building of UWA staff and others



interested (e.g. tour operators).

- Assess viability and practicality of establishing a student programme to monitor and analyse the data on giraffe more regularly in Kidepo Valley NP.

Permits

All necessary permits have been approved by the UWA and Uganda Council of Science and Technology. Additionally, a signed MoU between UWA, GCF and UWEC exists, which guides all giraffe conservation support in the country.

Conservation Partners

The project is part of a larger collaborative effort in Uganda underpinned by a Memorandum of Understanding (MoU) between the UWA, GCF and UWEC. Additionally, technical support from Dartmouth College was invaluable and all fieldwork in March 2019 was undertaken collaboratively with partners from GCF, UWA, Chester Zoo and San Diego Zoo Global, Rolling Hills Zoo, Naples Zoo and friends of GCF.





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